APPENDIX E
FISHERIES AND OTHER AQUATIC LIFE

Fisheries Overview

The Prospect Creek fish community was originally comprised of nine native species, with bull trout (*Salvelinus confluentus*) and westslope cutthroat trout (*Oncorhynchus clarki lewisi*) the representative char and trout species. Fish introductions in the Lower Clark Fork River and directly into Prospect Creek have increased fish community diversity (**Table E-1**). Introduced species including rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*) have affected this native fish assemblage through competition, hybridization, and predation.

Table E-1. Native and Introduced Fish Species Sampled in Prospect Creek

Native Fish Species	**Introduced Fish Species**
Bull trout	Rainbow trout (Pre-1919)
Westslope cutthroat trout	Brown trout (1945)
Largescale sucker	Brook trout (Pre-1913)
Northern pikeminnow	
Longnose dace	
Longnose sucker	
Slimy sculpin	
Mountain whitefish	
Peamouth	

Introduction dates from Pratt and Huston (1993).

Bull Trout and Westslope Cutthroat Trout

Bull trout, a federally listed threatened species (USDI, 1998), and westslope cutthroat trout recognized by the State of Montana as a Species of Special Concern (Roedel, 1999), are less numerous today than they were historically in the Lower Clark Fork River and Prospect Creek. The construction of Thompson Falls Dam, Noxon Rapids Dam, and the Cabinet Gorge Dam on the Clark Fork River likely affected the distribution and size of native fish populations utilizing Prospect Creek. Anecdotal accounts indicate that the two species were more abundant in the Prospect Creek watershed prior to widespread timber harvest, power line and gas pipeline construction, and habitat modifications (Pratt and Huston, 1993). Historical accounts by local residents suggest bull trout were once numerous in the watershed, with the 1949 bull trout spawning run numbering approximately 100 fish (Pratt and Huston, 1993). Other unverified and anecdotal accounts placed the number of spawning adults closer to 400 fish (Pratt and Huston, 1993). Bull trout were once numerous enough that local residents poached fish using dynamite caps affixed to the ends of long sticks and also spear-snagged fish from horseback (Pratt and Huston, 1993).

The introduction of several fish species has also affected the native fish community through competition, predation, and possibly hybridization. Introductions of brown trout, rainbow trout and brook trout in the early twentieth century may have also impacted the native fish assemblage in Prospect Creek. Brook trout and bull trout spawning periods overlap, commonly resulting in hybridization, although none have been observed in Prospect Creek (WWP, 1996, Katzman, 2003). Brown trout likely compete with bull trout at several life stages and also may superimpose on bull trout redds during spawning due to brown trout spawning occurring later than bull trout (Moran et. al., 2003). Bull trout and brook trout may also compete with bull trout at earlier life stages. Introduced rainbow trout populations commonly hybridize and compete with native westslope cutthroat trout which is likely occurring lower in the Prospect Creek drainage and possibly higher in the drainage (WWP, 1996). Introduced species interactions in the Noxon Reservoir likely also increase the risk of predation and competition. Introduced species found in Noxon Reservoir which may be impacting native bull and westslope cutthroat trout include northern pike, largemouth bass, smallmouth bass, walleye, rainbow trout, and brown trout (Liermann and Tholl, 2003).

The Prospect Creek drainage is considered core habitat for bull trout (MBTRT, 2000) and was proposed by the U.S. Fish and Wildlife Service (2002) as critical bull trout habitat. Tributaries such as Clear Creek and Wilkes Creek potentially provide important habitat for westslope cutthroat trout and bull trout. Bull trout are believed to have inhabited Clear Creek and Wilkes Creek in the past (Pratt and Huston, 1993). However, the current distribution of bull trout in these subwatersheds is unknown at this time. Bull trout are not believed to have inhabited Dry Creek in the past (Pratt and Huston, 1993). Westslope cutthroat trout maintain a strong population in the drainage. Channel intermittency in the middle and lower watershed temporally limits upstream migration of fish from the lower to upper watershed during low flow periods. Within the Prospect Creek watershed, bull trout and westslope cutthroat trout populations are Known Present Depressed in all stream segments except Cooper Gulch, which supports a strong westslope cutthroat population (USDA, 2000). Fish population status for Prospect Creek is included in **Table E-2**.

Table E-2. Status of Fish Populations in the Prospect Creek Watershed

6th Code HUC	Bull Trout	Westslope Cutthroat Trout	Rainbow Trout	Brown Trout	Brook Trout
Clear Creek	PD	D	PD	PP	S
Cooper Creek	S	S	PA	PA	PA
Crow Creek	D	D	PA	PA	PA
Dry Creek	PD	S	PD	P	PP
Lower Prospect	D	D	PD	S*	S
Upper Prospect	S*	S*	PD	PA	PD
Wilkes Creek	D	D	PA	PA	D

Reference: USDA 2000 and S. Moran, Avista, pers. comm. 2004
D = depressed, U = Unknown, S = Strong, PP = Presumed Present, PA = Presumed Absent, PD = Present Depressed, PS = Present Strong, P = Present
* Liermann et al. 2003

Fish Population Summary

Quantitative fish population estimates have been completed on Prospect Creek since the early 1990s when a cooperative effort that included WWP (Washington Water Power Company), MFWP, and USFS completed an electorfishing study (WWP, 1996). In 2000, Montana Fish, Wildlife & Parks conducted an in-depth study to document the status and life history strategies employed by bull trout and westslope cutthroat trout inhabiting Prospect Creek (Katzman, 2003). Electrofishing and redd counts are replicated biannually by MFWP and Avista on three reaches of Prospect Creek.

The sampling results from 1992 through 1994 suggested fish populations are limited by channel instability, dewatering, infrequent woody debris accumulations, and poor spawning and rearing habitat conditions. Stable reaches supporting complex aquatic habitats had higher fish counts (WWP, 1996). Monitoring results suggest Prospect Creek supports migratory and possibly resident life history forms of native bull trout and westslope cutthroat trout, in addition to similar life history forms of introduced salmonids including brown trout and rainbow trout. Resident brook trout were also present in the watershed (MFWP, 2003).

Bull Trout

Redd counts completed since 1993 suggest Prospect Creek is an important bull trout spawning tributary in the Lower Clark Fork River (WWP, 1996 and Katzamn, 2003). The presence of large redds were identified in the perennial reach of Prospect Creek in 2000 (1 migratory fish), 2001 (6 redds), and 2002 (4 redds). Redd surveys were typically completed prior to the end of bull trout spawning (Katzman, 2003). Survey timing may have resulted in an incomplete sampling of bull trout redds.

Bull trout population estimates based on electrofishing results approximated between 4.9 and 30.4 bull trout per 100m in upper Prospect Creek (WWP, 1996 *as cited in* Katzman, 2003). Low numbers of juvenile bull trout outmigrating from the watershed may indicate low bull trout reproductive success in the watershed. However, low estimates may also be related to poor trap efficiency due to trap avoidance by outmigrating juvenile bull trout and marginal sampling effort (Katzman, 2003). Bull trout embryo survival was considered moderate relative to other tributaries in the LCF (WWP, 1996).

Although not directly comparable due to differences in sampling locations, the MFWP electrofishing surveys yielded fish population estimates similar to the WWP (1996) surveys. Upper Prospect Creek bull trout estimates remained similar from 1999 to 2002, annually varying from 4.9 to 37.0 fish per 100 m (Katzman, 2003). These results were similar to bull trout densities in other tributaries to the Lower Clark Fork River (Katzman, 2003).

Westslope Cutthroat Trout

Electrofishing population estimates conducted in 1999 were similar to the WWP (1996) results. Westslope cutthroat trout populations in the WWP investigations ranged from 56.5 to 59.7 fish per 100 m. The MFWP survey estimated 34.2 to 60.7 fish per 100 m. Although the WWP and MFWP surveys were not completed in the same sample reaches and the results are not directly comparable, the westslope cutthroat population estimates in upper Prospect Creek was similar between the two surveys (MFWP, 2003). In general, westslope cutthroat trout density estimates appear to be similar to densities observed in other tributaries of the Lower Clark Fork River drainage during 2000, 2001, and 2002 (Katzman, 2003).

Other Species

Rainbow trout dominated the majority of the trout and char greater than 40 mm total length (TL) sampled by a rotary screw trap used to sample emigrating juveniles in 2000 and 2001 (Katzman and Tholl, 2003). From march to July, rainbow trout greater than 40 mm TL comprised 50% of trout captured by the screw trap in 2000, and 65% of trout captured by the trap in 2001 (Katzman, 2003). Rainbow trout were not sampled during electrofishing investigations in upper Prospect Creek.

Brown trout comprised 29% of the trout and char greater than 40 mm TL sampled by the rotary screw trap in 2000, and 16% in 2001 (Katzman and Tholl, 2003). Many unidentifiable age-0 salmonids sampled in the spring by the rotary trap may have been larval brown trout. Brown trout were not surveyed in upper Prospect Creek during the electrofishing projects from 1999 to 2002.

Aquatic Macroinvertebrates

Several studies have sampled aquatic macroinvertebrate in Prospect Creek and its tributaries.

- The USFS PIBO study (PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program) collected and analyzed aquatic macroinvertebrate samples in Cooper Creek and Dry Creek in 2002. These data were further analyzed by DEQ for this document.
- Montana DEQ collected and analyzed samples in Clear and Dry Creeks in 2003 and
- WWP collected and analyzed aquatic macroinvertebrate samples in Prospect and Crow Creeks in 1994. These data were further analyzed by DEQ for this document.

Summary values and indices include average species richness, average percent EPT assemblage, average Shannon's diversity index, Hilsenhoff Biological Index (HBI), and the mountain ecoregion index of biological integrity (mountain IBI) used by DEQ as an indication of impairment to aquatic life. Species richness is reported as the average number of different taxa. Average percent EPT is the percent of the sample which consists of mayflies, caddisflies, and true flies (ephemeroptera, trichoptera, and diptera). Percent EPT values range from 0 to 100. The higher the percent EPT, generally the healthier the aquatic invertebrate community as most EPT species are typically considered sensitive to pollution and also make up a significant part of salmonid diet. Average Shannons' diversity index accounts for species abundance and how evenly species are distributed. In the sites sampled, values range from 2.07 to 3.33, with values around 2.0 indicating moderate diversity and some potential impact to the aquatic invertebrate community, and 3.0 or higher indicating a more desired condition. The Hilsenhoff Biological Index, using species level data, indicates pollution tolerance levels. HBI values range from 0 to 10, 0 indicating no impairment (intolerant species) and 10 indicating impairment (tolerant species). Mountain IBI is a comparison of multiple sample metrics to reference condition streams in the mountain ecoregion, assuming reference conditions are 100% (Bukantis, 1998). For mountain IBI, values greater than 75% indicate full support of aquatic life, 25-75% indicates partial support of aquatic life, and less than 25% indicate non-support of aquatic life. Note that an indication of partial or non-support for aquatic life (macroinvertebrate in this situation) can also be an indicator of partial or non-support of a cold-water fishery since the water quality conditions impacting the aquatic life can also impact cold-water fish, and the impacted macroinvertebrate populations can also impact the food supply for cold-water fish. An indication of full support for aquatic life can also be an indicator of full support for cold-water fish although there are habitat and other water quality type conditions that could have negative impacts on cold water fish but not necessarily impact macroinvertebrates enough to indicate impairment using the mountain IBI. **Table E-3** summarizes the select values and indices of these various studies.

In the 2002 PIBO study of Cooper and Dry Creeks (USFS, 2003), data were collected for two reaches in each stream. Species richness and percent EPT in Cooper Creek are moderate to high (richness: 13 and 21 and EPT 77%). HBI values were low (2.09, 1.82) and mountain IBI values were moderate (67%).

For Dry Creek, species richness and percent EPT were low (richness: 9 and 13, EPT: 25% and 5%). HBI was low (2.16 and 1.98) and mountain IBI was low (46% and 42%). These data, particularly the mountain IBI, indicate impairment in both Cooper and Dry creeks, although the impairment does not suggest a metals problem. USFS macroinvertebrate data collection methods vary from those used by Montana DEQ. USFS data identifies midges to the subfamily level and, therefore, midge numbers are underestimated. (D. Feldman, pers. comm., 2005).

The 2003 Montana DEQ assessment of macroinvertebrates conducted by Bollman (2003) indicate full use support of aquatic life at both Clear Creek sites and partial to non-support of aquatic life at the Dry Creek site.

At the upper Clear Creek site, species richness, percent EPT and Shannon’s diversity index were all high (44, 82%, and 3.33, respectively) (**Table E-3**). HBI was low (1.48) and mountain IBI was high (90%). Based on the DEQ assessment files, findings suggest excellent water quality and substrates free from fine sediment deposition, reach-scale habitat features such as bank stability, riparian integrity, and channel morphology were intact. Flow was perennial and substrate scouring sediment pulses or toxic inputs were absent. The only metric reducing the DEQ score was a relatively low percentage of scrapers and shredders (26% of fauna). No sediment tolerant taxa were present and 3 sediment sensitive taxa identified. One-half of the fauna identified were cold stenotherm taxa. The metals tolerance index was low (1.54).

At the lower Clear Creek site, species richness, percent EPT and Shannon’s diversity index were all relatively high (39, 78%, and 3.10 respectively). HBI was low (2.29). Mountain IBI was also relatively high (81%). The number of sensitive taxa was slightly reduced and the percent of filterers was slightly elevated. Percent scapers and shredders was very low (14%). One sediment tolerant taxa and 2 sediment sensitive taxa were identified. Twelve percent of the fauna identified were cold stenotherm taxa. The metals tolerance index was low (1.54). These indicators at lower Clear Creek site suggest high water quality.

At the Dry Creek site, species richness was moderate (22), percent EPT was low (5%), and Shannon’s diversity index was moderate (2.07). HBI was moderate (3.98) and mountain IBI was low (29%). There was only one sensitive taxa identified and percent filterers was slightly elevated. Percent tolerant taxa was very low. Midges dominated the sample, and non-insect made up the next most abundant group. There was a low number of clingers (6 taxa) and caddislfly larvae (3 taxa). This suggests fine sediment may compromise the substrate. The assemblage was "overwhelmed" by gatherers which typically indicates water quality degradation. Low taxa richness may indicate monotonous habitats. The biotic index was somewhat elevated (3.98) and the metals tolerance index value was high (6.35). The high metals index coupled with the finding of a single heptageniid mayfly suggest the potential for metals pollution. Other possible disturbances include fine sediment deposition and disruption of reach-scale habitat features such as unstable streambanks, loss of riparian zone function, or disturbance of natural channel components. These indicators suggest partial to non-support of aquatic life in Dry Creek.

Table E-3. Aquatic Macroinvertebrate Summary Statistics for Prospect Creek Watershed

Reach	Data Source	Species Richness (Ave.)	Percent EPT (Ave.)	Shannon's Diversity Index (Ave.)	HBI (Ave.)	Mountain IBI (Ave.)*
Clear Lower	DEQ 2003	39	78%	3.10	2.29	81%
Clear Upper	DEQ 2003	44	82%	3.33	1.48	90%
Cooper 19630	PIBO 2002	21	77%	--	2.09	67%
Cooper 123107	PIBO 2002	13	77%	--	1.82	67%
Crow 1	WWP 1996+	8	45%	--	8.75	36%
Crow 2	WWP 1996+	9	91%	--	2.05	59%
Dry 123109	PIBO 2002	9	25%	--	2.16	46%
Dry 119632	PIBO 2002	13	28%	--	1.98	42%
Dry	DEQ 2003	22	5%	2.07	3.98	29%
Prospect Creek Average	WWP 1996+	22	84%	2.77	--	--
Prospect 1	WWP 1996+	11	85%	--	3.23	52%
Prospect 2	WWP 1996+	14	77%	--	3.89	41%
Prospect 4	WWP 1996+	14	77%	--	5.49	41%
Prospect 5	WWP 1996+	10	88%	--	3.23	46%
Prospect 6	WWP 1996+	10	93%	--	3.18	49%
Prospect 7	WWP 1996+	8	96%	--	2.47	52%

*Multimetric index based on the mountain ecoregion IBI method described in Bukantis 1998.
+ Additional analysis performed by DEQ.

In the WWP study (1996), which sampled mainstem Prospect Creek and Crow Creek, taxa were identified to the family level and some to the generic level. As a result only general conclusions may be drawn from this data (D. Feldman, pers. comm., 2005). Samples were dominated by ephemeroptera (mayflies, 39 percent), trichoptera (caddisflies, 34 percent), and diptera (flies, 14 percent). In general, species richness was relatively high (22), percent EPT was also high (84%), and Shannon's diversity index was relatively low (2.77) compared to other macroinvertebrate communities in other tributaries in the Lower Clark Fork River drainage (WWP, 1996).

In 2005, Montana DEQ re-analyzed 1994 macroinvertebrate data summarized in WWP 1996 for Crow and Prospect creeks. Species richness in Prospect Creek was low to moderate (8-14) while percent EPT was moderate to high (77-96%). Shannon's diversity index was not calculated for the Prospect Creek sites. HBI values were moderate for all Prospect Creek sites, ranging from 3.47 to 5.48, with an average of 3.58. Mountain IBI for all Prospect Creek sites fell into the 25-75% partial support category with values ranging from 41-52% (**Table E-3**). These data for Prospect Creek suggest possible impairment conditions.

In Crow Creek, species richness was low at both sites (8-9), and percent EPT was low at site 1 (45%) and high at site 2 (91%). Shannon's diversity index was not calculated for the Crow Creek sites. HBI values were very high at site 1 (8.75) and low at site 2 (2.05). Mountain IBI values were low at site 1 (36%) and moderate at site 2 (59%). These data for Crow Creek suggest partial impairment at site 2 and possibly non-support at site 1.

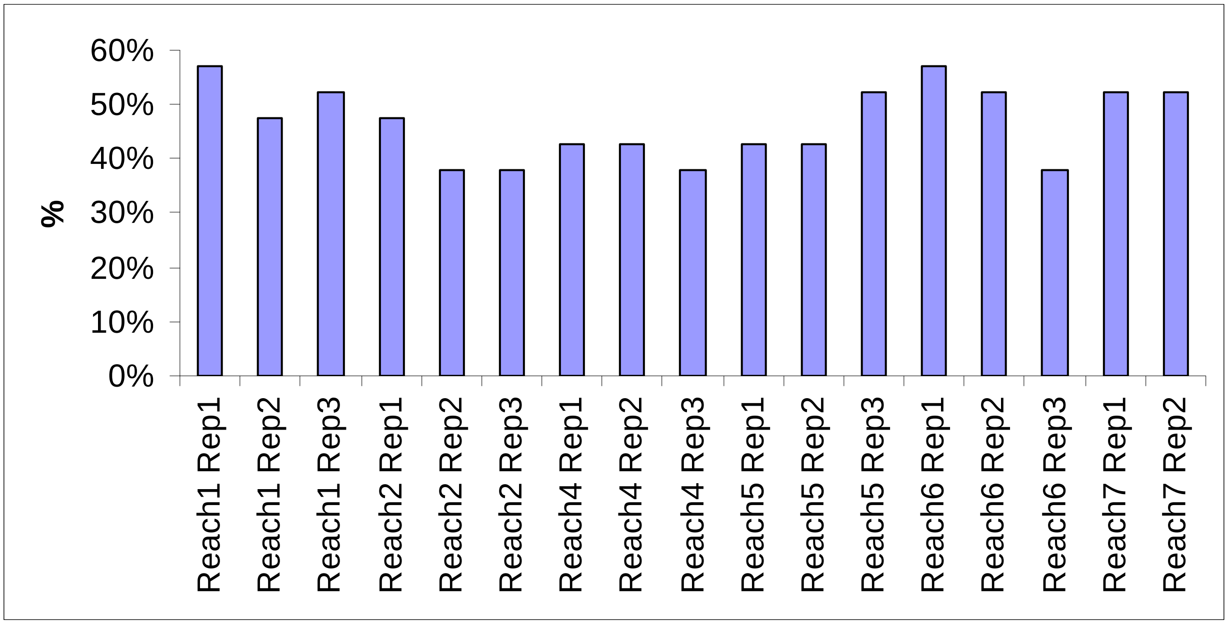

Figure E-1. Mountain IBI Values for Prospect Creek Data Collected in 1994 and Re-Analyzed by Montana DEQ in 2005
Reference: WWP 1996

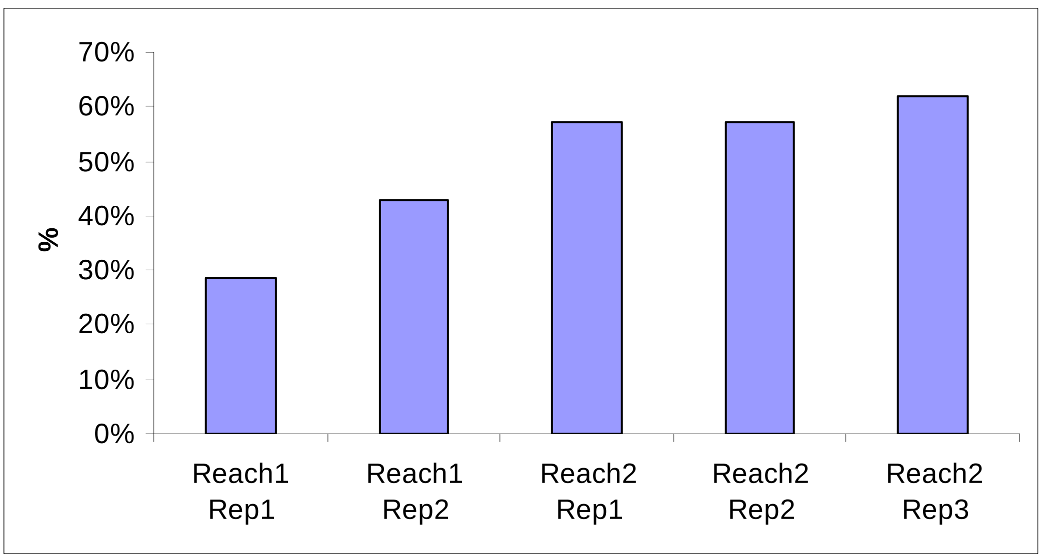

Figure E-2. Mountain IBI Values for Crow Creek Data Collected in 1994 and Re-Analyzed by Montana DEQ in 2005
Reference: WWP 1996

Primary Productivity and Periphyton

Primary productivity and periphyton were evaluated in two studies, WWP (1996) and Bahls (2004). WWP examined periphyton and chlorophyll a production in Prospect and Crow creeks. Bahls assessed biological integrity via algal assemblages and diatom matrices in Clear and Dry creeks.

The WWP study quantified periphyton in Prospect and Crow creek samples after growing for 39 days on artificial substrates. The average autotrophic index was relatively low while the chlorophyll *a* production and net productivity were high compared to other tributaries in the Lower Clark Fork River (WWP, 1996).

Table E-4. Primary Productivity Summary Statistics for Prospect Creek

Parameter	Average	Relative to Other LCFR Tributaries
Ave. Autotrophic Index	3.64	Low
Chlorophyll a (mg/m2)	3.94	High
Net Productivity (mg/m2/day)	0.75	High

Reference: WWP 1996

The 2003 Montana DEQ assessment of periphyton conducted by Bahls (2004) found that periphyton in both Clear and Dry creek indicate “good to excellent biological integrity”, “no impairment”, and “full support of aquatic life uses”. Sediment, organic and temperature indicators were slightly elevated at the lower Clear Creek site. Other stressors indicated by the results for the lower Clear Creek site were attributed to natural causes. Sites on Dry Creek and upper Clear Creek supported coldwater algal floras. Inorganic nutrients were slightly elevated at the Dry Creek site whereas organic nutrients were slightly elevated at the upper Clear Creek site. For all sites, periphyton indicator levels did not exceed impairment indicator thresholds

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